

western Asia before it followed the big game into Africa (the last refuge of the latter before the advancing power of Neolithic man). But if protection from cold and wet be the inducement which led to the development of a mane in the male lion, how about the lioness? The more probable explanation is that the mane of the lion arose both as a male ornament and as a protection for the throat and chest in sexual combats with other males. Mr. Selous comments on the distinctly spotted limbs possessed by some adult lions and lionesses; he quotes the special name given to this type by Boer hunters. He will have been interested in the paper by Mr. R. I. Pocock in the *Annals and Magazine of Natural History* (November, 1907) on the significance of the pattern—the rosettes, spots and stripes—of the cubs of lions (and of pumas).

The author's notes on the fluctuations of the abundance and distribution of the tsetse fly and its correlation with the abundance or scarcity of the buffalo are important contributions to a subject of great economic importance. His remarkable sporting adventures are the more thrilling because of their obvious truth, and the quiet style of narration.

The last chapter in the book is as valuable as any in a work which is interesting from beginning to end. It is devoted to the Bushmen of South Africa—more especially the Masarwa dwelling on the verge of the Bechuana countries.

Mr. Caldwell's drawings are admirable (especially the study of galloping gemsbuck). Very interesting are the photographs and description contributed by an American sportsman, Mr. Max Fleischmann, of a rhinoceros being dragged under water (presumably) by crocodiles.

H. H. JOHNSTON.

WATER POWER.

Hydraulics and its Applications. By A. H. Gibson. Pp. xvi+757; with diagrams and illustrations. (London: Archibald Constable and Co., Ltd., 1908.) Price 18s. net.

IN this intensely practical age, science is chiefly exploited for utilitarian ends. The fascination of experimental research lies, as Cap'n Cuttle would observe, "in the application thereof." We seek to know, not for any mere pleasure to be derived from the acquisition of knowledge, but in order to bring that knowledge to bear upon everyday problems of life, labour, and economy.

There is something, therefore, particularly fitting and appropriate in the title of Mr. Gibson's book, "Hydraulics and its Applications," for hydraulics is an eminently practical branch of natural science. Moreover, it is a science difficult to define in that it has no fixed limitations. It embraces the study of all questions in hydro-mechanics in which the motion of water produces or is connected in any way with useful work. In a very special sense it lies within the province of the engineer and the manufacturer.

On its theoretical side, hydraulics presents a number of difficulties. Assumptions have to be made which are not strictly justifiable in reality; yet without them

the solution of problems would be well-nigh impracticable. There is, therefore, something necessarily of the nature of compromise about the subject, and Mr. Gibson strikes this keynote at the outset of his work by explaining that the questions of hydraulics can only be discussed on the basis of the assumption that water is a perfect fluid (which it is not), absolutely non-viscous and inelastic, with the introduction of empirical constants to bring theoretical results into conformity with the records of actual observation.

Despite, however, the very practical suggestion of its title, Mr. Gibson's treatise must be set down as primarily a theoretical work. It postulates a knowledge of mathematics and mathematical processes which the ordinary practical man unfortunately rarely possesses. And while the operator, as distinct from the experimentalist, will no doubt fully appreciate the useful data contained in the volume and the information condensed into working formulæ, he will at the same time be inclined to regret that Mr. Gibson has not dealt a little more completely with the practical side of the subject, by describing in greater detail the remarkable variety of ways in which hydraulic machinery is utilised in commerce, manufactures, and the arts.

Commencing with two prefatory chapters on hydrostatics and the physical properties of water, in which such matters as capillarity and the laws of floating bodies are briefly discussed, the author introduces his main subject in chapter iii. by describing the experimental results obtained by Profs. Osborne Reynolds and Hele-Shaw in regard to stream line flow. The motion of fluids is then mathematically investigated and its phenomena explained in relation to pipes, bends, vortices, and orifices. This leads on to the laws of fluid friction and the resistance of ships, whence the author reverts once more to pipe and channel flow, and the various sources of loss of head and velocity. Chapter x. takes up the question of impact of jets and of pressure on submerged planes. It is not until chapter xi. is reached that the practical side of the subject comes under discussion, and then the various and well-known types of water-wheel are duly described and illustrated, including the Pelton motor. Chapter xii. deals with turbine forms, and chapter xiii. with the theory of turbine design. In chapter xiv. there is an account of the hydraulic reciprocating engine, with examples of the Brotherhood and Rigg machines. Chapters xv. to xvii. are devoted to pumps, including the hydraulic ram. The transmission of energy by means of pressure mains forms the subject of chapter xviii., while the final chapter contains a brief review of a number of important appliances: lifts, hoists, jacks, cranes, and jiggers. It is this latter portion of the book—the manipulative aspect of hydraulics—that one would have liked to see expanded, even, if necessary, at the expense of some of the earlier mathematical matter. The commerce of Great Britain is essentially maritime, and a very large proportion of port and harbour machinery is hydraulic. Dock gates, sluice penstocks, capstans, coal elevators and tips are worked in the great majority of cases by hydraulic power, and despite their

importance none of these appliances is illustrated in the book. Quay cranes also, a most important class, are not represented, though some of them are capable of dealing with loads up to 150 tons.

We think that in one or two cases the matter might have been arranged to rather better advantage, but, on the whole, we have no hesitation in saying that the book is an excellent contribution to the literature of the subject, and embodies the result of no little personal investigation and research. It is specially a student's book, and will appeal more particularly to those who are already equipped with some fundamental knowledge of hydraulics. The book is clearly printed and well illustrated.

THE DISCOVERY OF THE WEIGHT OF THE AIR.

Essais de Jean Rey. 1630. Edition nouvelle avec commentaire par Maurice Petit. Pp. xxvii+191. (Paris: A. Hermann, 1907.) Price 7 francs.

SHORTLY after Lavoisier had presented an account of his researches on calcination to the Academy of Sciences, the French chemist Bayen discovered in the Bibliothèque royale a small volume dated 1630, in which the discoveries and views of Lavoisier were seen to be anticipated by nearly a century and a half. This volume was the "Essays de Jean Rey sur la Recherche de la cause pour laquelle l'Estain et le Plomb augmentent de poids quand on les calcine," of which a translation in English was published some years ago under the auspices of the Alembic Club (1895). By a curious coincidence, the title of Lavoisier's memoir, "Sur la calcination de l'étain dans les vaisseaux fermés et sur la cause de l'augmentation de poids qu'acquiert ce métal pendant cette opération," was almost identical with that of Rey's essays; and it is remarkable that the study of the behaviour of the same metal, tin, when calcined, led both chemists to arrive at a correct interpretation of the nature of combustion.

The salient characteristic of Rey's work is that he concentrated his attention on the increase of weight of metals during calcination, and was thus led to recognise that the air has weight prior to the investigations of Torricelli in 1643 and of Pascal in 1648. The increase of weight was explained as follows:—

"Ce surcroit de poids vient de l'air, qui dans le vase a esté espessi, appesanti et rendu aucunement adhesif, par la véhémence et longuement continuée chaleur du fourneau; lequel air se mesle avecques la chaux (à ce aydant l'agitation fréquente) et s'attache à ses plus menuës parties."

The object of the new edition of Rey's works appears to be, not so much to direct attention to the part played by Rey as chemist and precursor of Lavoisier, but to put in a claim on his behalf as the discoverer of the weight of the atmosphere and as inspirer of the later work of Torricelli and Pascal. When's Rey's "Essays" were printed in 1630 at Bazas, in a form hardly likely to attain much publicity, a copy came into the hands of a certain Frichet, a lawyer of Bordeaux, who placed the results before a circle of learned friends who assembled weekly in the

rooms of the Père Mersenne at the monastery of Les Minimes, in Paris. Père Mersenne became the correspondent of Jean Rey, and, it would appear, communicated the latter's investigations to Torricelli, Galileo, Descartes, and Pascal, with whom he was in constant correspondence. Thus Rey's book "loin d'avoir été un éclair de génie inconnu, ignoré, comme on l'a supposé jusqu'ici, devient le point de départ de cette mémorable campagne scientifique qui se termina par les victorieuses expériences de Rouen et du Puy-de-Dôme."

In support of these contentions a number of letters of Jean Rey and of Père Mersenne are published, and the relationship of Mersenne with his great contemporaries traced in detail. Frémy long ago expressed the conviction that the lack of appreciation of Rey's work as compared with that of Torricelli and Pascal was "one of the great injustices committed in the history of science." The editor of the new edition of the "Essays" aims at rectifying this injustice, so that Jean Rey may take rank not merely as a chemist and first discoverer of the part played by air in combustion, but as one of the founders of modern physics.

W. A. D.

OUR BOOK SHELF.

Plant Anatomy from the Standpoint of the Development and Functions of the Tissues, and Handbook of Micro-technic. By Prof. W. C. Stevens. Pp. xii+349. (London: J. and A. Churchill, 1908.) Price 10s. 6d. net.

ACCORDING to the axiom that the greater contains the less, there is justification for the title of the book, but so far as histology is distinguished from anatomy, the contents pertain rather to the domain of histology. This does not, however, correctly explain the nature of the subject-matter, as the author has followed the modern, and one has no hesitation in saying the best, practice of uniting the study of form and function; in fact, each chapter is devoted to a separate physiological problem. The arrangement is an excellent one for an elementary book, but it must be added that there is no attempt to rise beyond elementary facts. The difficulties of the stellar theory are avoided by reverting to the older conception of protoderm, procambium strands, and fundamental meristem. "Bast fibres," as here explained, also show a return to an older, though in this case less acceptable, definition, and the nicer subtleties of distinction between fibrous cells and wood fibres are omitted. The careful and detailed descriptions of such processes as the conduction of water and solutes through the stem will be fully appreciated, but in places the author shows but small regard for the intuitive perception of the student (*vide* figs. 56, 87, and 92). The practical examples quoted at the end of the chapters are useful, and the general presentation of the subject-matter is marked by clearness and coordination.

Following on the course of anatomy is a handbook of micro-technique. This science has been eagerly absorbed by American students sojourning in Europe, with the result that their experience has spread like leaven throughout the numerous colleges and universities in the United States. The instructions here conveyed represent the most modern and approved practice. In this country it is not the custom to push students into complex fixing and staining methods until they reach the advanced or research stage, so that it appears inconsistent to devote a third part of